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“Cosmic Dawn : Physics of the First Stars, Supernovae, and Galaxies”

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One of the paramount problems in modern cosmology is to elucidate how the first generation of luminous objects, stars, supernovae, accreting black holes, and galaxies, shaped the early universe at the end of the cosmic dark ages. According to the modern theory of cosmological structure formation, the hierarchical assembly of dark matter halos provided the gravitational potential wells that allowed gas to form stars and galaxies inside them. Modern large telescopes have pushed the detection of galaxies up to a redshift of $z \sim 10$. However, models of the first luminous objects still require considerable effort to reach the level of sophistication necessary for meaningful predictions. Due to the complexity of involved physical phenomena, this physical understanding may only come by the proper use of numerical simulations. Therefore, I have used state-of-the-art simulations on some of largest supercomputers to study these objects. In my talk, I will discuss the possible physics behind the formation of these first luminous objects by presenting the results from our simulations. I will also give possible observational signatures of the cosmic dawn that will be the prime targets for the future telescopes such as the James Webb Space Telescope (JWST).